

EVALUATING A MINDFULNESS INTERVENTION AS AN
AID FOR DIETARY CHANGE

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ABSTRACT

Mindfulness refers to awareness in each moment. Jon Kabat-Zinn, at University of Massachusetts Medical School developed Mindfulness-Based Stress Reduction (MBSR) to help patients with chronic pain and stress-related disorders. The program requires a 2-3 hour meeting/week and 45-60 minute daily meditation for 8 weeks. Researchers at The Ohio State University created and tested a low-dose (ld) version, (MBSR-ld), in a clinical trial. Both MBSR and MBSR-ld include mindful eating. MBSR has been effective in eating disorders but hasn't been examined in the non-clinical subject. The focus of this study was to examine the impact of mindfulness training on eating behaviors in the non-clinical subject. In the MBSR-ld study there were 90 participants in each group. The primary hypothesis was that participants in the mindfulness group would display greater changes in eating behavior than the active control group, a lifestyle education program, as measured by food frequency questionnaires (FFQ). A second hypothesis was they would become more mindful pre/post as measured by five daily diary questions on eating patterns. The final hypothesis was the mindfulness group would show a greater increase in mindfulness as measured by the validated MAAS (mindfulness attention awareness scale). MAAS measures dispositional mindfulness and awareness in the present moment. Daily diaries were completed for two weeks pre and two weeks post-intervention. The MAAS was completed once pre and once post-intervention. See Appendix I for the MAAS. While pairwise t-tests revealed the active control group exhibited an increase in consumption of fruits and vegetables ($p = 0.01$), the mindfulness group had changes such as a decrease in consumption of breads ($p = 0.02$), meats ($p = 0.00$), and alcohol ($p = 0.06$), and was more

mindful in eating patterns ($p = 0.01$). Both groups increased MAAS scores which may be attributed to both programs increasing overall awareness. However, the mindfulness group received 1/8 weeks focused on food and eating behaviors and the active control group received similar lessons in 6/8 weeks. Both groups experienced benefits of becoming aware of eating behaviors however the mindfulness training allowed the information to be learned and applied in less time. Mindful eating may be an effective approach towards dietary change.

INTRODUCTION

The obesity epidemic in our country is a very real situation. Since 1985 the number of people weighing in the overweight and obese BMI categories, $>30\text{kg body weight/m}^2$ in height, have drastically increased (CDC, 2009). According to the Center for Disease Control and Prevention (CDC), in 2007 all of the fifty states in the union had greater than 15% of their population in the obese range. This is a serious problem for our country, beyond those who are a part of the statistic, as the costs of the obesity epidemic impact national healthcare costs. As a result, there are programs being implemented in communities such as schools and the workplace to help increase activity and/or consciousness of eating habits. These programs may be a step in the right direction and according to many behavioral theories lifestyle changes are more successful with support (Glanz, Rimer, & Viswanath, 2008). And, the individual who wants to

change must be mentally prepared for the change before any sustainable changes are possible (Prochaska, 1982).

Emerging research indicates that a mindful eating approach could result in individuals being more aware of what they eat, how they eat, and how much they eat (Baer, 2006). This concept stimulated the interest for looking at dietary changes impacted by a mindfulness intervention. This study examined data collected in the *Chronic Inflammation and Mindfulness Intervention* study conducted at The Ohio State University. We examined the impact of a low-dose mindfulness intervention on the participants' food group choices, perceived mindful behaviors while eating, and overall mindfulness. If effective, then a mindfulness approach that includes instruction on mindful eating may be an approach that could help people struggling with dietary change. While eating mindfully the consumer is completely aware of the food they are eating, their body's reaction to the food, and the pleasure that comes with eating.

Mindfulness-Based Stress Reduction (MBSR) was developed to help patients with chronic pain and stress-related disorders. The program requires a 2-3 hour meeting each week and 45-60 minute daily meditation for 8 weeks. The National Institute of Health (NIH) funded study at OSU, *Chronic Inflammation and Mindfulness Intervention*, utilized a mindfulness-based stress reduction low dose (MBSR-ld) program for the experimental arm. The MBSR-ld program was based upon Jon-Kabat Zinn's extensive eight week program but was modified to be less time intensive, thus better able to be integrated into one's daily routine. According to behavior change theories, perceived barriers are the greatest predictor of behavior (Glanz et.al. 2008). The time investment of Kabat-Zinn's MBSR may be people's biggest perceived barrier and this has been shown to be an important element in participant adherence (Williams et. al. 2001). Participants in the *Chronic Inflammation and Mindfulness Intervention* did not have this barrier.

The researchers recognized the incredible benefits of Kabat-Zinn's approach and wanted to make such a program accessible to the average working adult (Klatt, Buckworth, Malarkey, 2009).

During the MBSR-ld study, participants answered questions in daily online diaries. These diaries were completed for two weeks prior to the intervention and two weeks after the intervention. The eleven page diaries involved a broad range of topics such as sleep quality, physical activity, emotions, and eating patterns, however for the purposes of this specific project, only the sections on food choices and eating patterns were analyzed. The primary hypothesis was that participants in the mindfulness group would display greater changes in eating behavior than the active control group, a lifestyle education program, as measured by the modified daily food frequency questionnaires. A second hypothesis was that the mindfulness group would become more mindful pre/post as measured by five daily diary questions on eating patterns. The final hypothesis was the mindfulness group would show a greater increase in mindfulness as measured by the validated Mindfulness Attention Awareness Scale (MAAS) which measures dispositional mindfulness and awareness in the present moment (Brown and Ryan, 2003).

LITERATURE REVIEW

There are a number of completed as well as ongoing studies that look at topics related to the benefits of mindful eating as well as the dangers of mindless eating discussed below. The following literature review includes studies on mindfulness and eating disorders including binge eating, weight control and weight cycling, emotional mindless eating, intuitive eating and

nutrition transition, mindfulness and type II diabetes, and the development of a mindful eating questionnaire.

Gast and Hawks in *Weight Loss Education: The Challenge of a New Paradigm* claim that health educators now have an added dimension to their careers due to the increasing numbers of obese people in the United States. Weight loss counseling and diet education has always been a part of their job however those that are obese tend to eat for non-physiological reasons. Thus their nutritional knowledge or lack thereof may have little bearing on their weight issues. Gast and Hawks suggest that people tend to eat mindlessly when there are environmental triggers, social situational pressures, or emotional reasons such as boredom or anxiety. When one gains a sense of what their body really needs and then attends to those needs, they will be “able to eat whatever they want and still lose weight”. Other weight loss programs tend to ignore the emotional relationship some people have with food which can be a deciding factor in a person’s eating habits (Gast & Hawks, 2007). Gast and Hawks use the term ‘intuitive eating’ which is essentially the same concept as mindful eating. When one does not listen to their body or their intuition, they tend to eat mindlessly. They present this mindful eating approach as “liberating” to those who are tired of counting calories or cutting out essential food groups from their diets.

This is supported by Brian Wansink’s *Mindless Eating* (2006), in which he identifies four unhealthy food-tool extremes. The four extremes are “food as reward, food as comfort, food as punishment, and food as guilt”. He suggests these will condition children at a young age to associate emotions with food. Wansink claims this is a poor practice that could potentially lead to mindless eating in the child’s future. Additionally, no foods should be labeled as good foods or bad foods. “The best diet is the one you don’t know you’re on” (Wansink, 2006). Wansink’s text has numerous suggestions for making small changes to combat mindless eating. These

include strategies such as portion distortion; eating out of smaller packages/containers, or eating off of smaller plates, encouraging the mind subconsciously to think the body is eating more than it is. Many studies referenced in Wansink's text indicated that when people have larger portions of any food or drink and are somewhat distracted while eating, they tend to eat many more calories than they want or need (Wansink and Cheney, 2005, Wansink, 1996, and Wansink, 2004).

For example, a study was done on intuitive eating with two large samples of college women that addressed the issue of emotional eating and body appreciation as a predictor of intuitive eating (Avalos and Tylka, 2006). Avalos and Tylka focused mainly on the environment as being influential in food decisions especially in the sense of being accepted by others in one's environment. Acceptance by others and inter-relationships are two concepts that are affected by emotions. "When women perceive that others accept their bodies, they may be less preoccupied with changing their outer appearance and pay more attention to how they feel and function" (Avalos and Tylka, 2006). Being aware of how one feels and functions is the main premise of intuitive or mindful eating. If one understands how the body functions, they are more likely to respond to its hunger cues as opposed to external cues. There was also an intuitive eating study done in Asia that addressed specifically the types of diet changes that would likely occur with an adapted mindful lifestyle (Hawks et.al, 2004). The study mentions the increasing rates of "obesity and diet-related non-communicable diseases" in not only America but in all of the developing world due to the modern demand for convenience foods which are often processed and lack in nutrients. Similar to the Avalos and Tylka article, Hawks et. al (2004) attributes diet change to environmental changes such as a shift from more physical labor to more sedentary jobs. Hawks et.al.(2004) details the nutrition transition believed to result from adopting a more

intuitive eating pattern as well as the diet changes that may occur or have already occurred as a result of environmental and cultural influences. See Figure 1 (Hawks et.al, p.195, 2004).

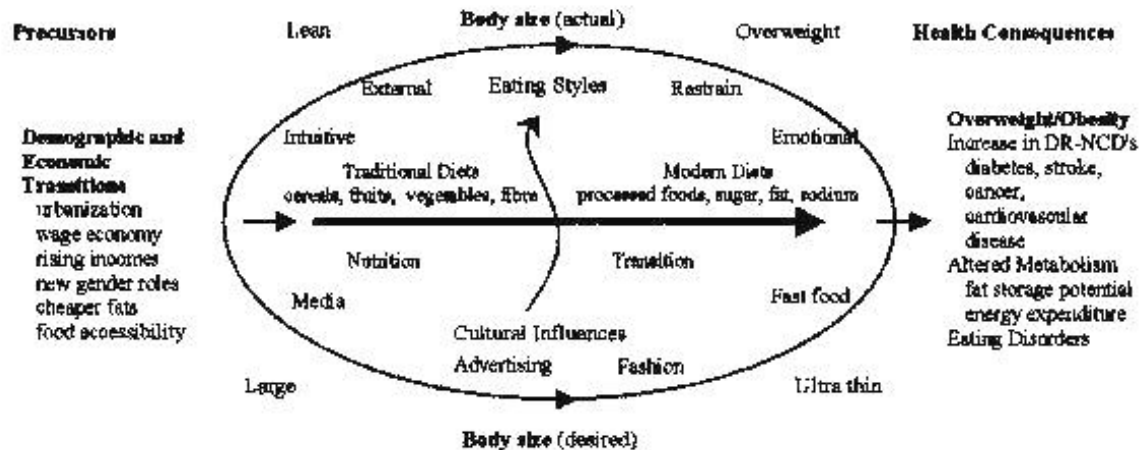


Figure 1. The nutrition transition, eating styles and public health consequences

For example, the traditional and natural diet our body wants includes cereals, fruits, vegetables, and fiber however the modern diet our body has been conditioned to crave includes processed foods, sugar, fat, and sodium. Hawks et.al. (2004) shows that developing countries that have moved to a more fast-paced lifestyle (contradicting the intuitive lifestyle), now all have citizens that have issues with obesity and mindless eating. Surveys were taken from people of the United States, Thailand, Philippines, Japan, and China (Hawks et.al, 2004).

Field et.al (2004) looked specifically at women and their experiences with weight control, weight cycling, and bingeing. This study also addressed the seriousness of the obesity epidemic in our country, considering it to be the result of lifestyle factors. According to Serdula et.al., women who intentionally diet and try to lose weight are also weight cyclers and tend to be overweight or obese. Field et.al. suggests that weight cycling and excessive weight are predictors for severe and

sometimes life-threatening diseases which is why it is more beneficial to make an entire lifestyle change to lose weight as opposed to “getting on” a temporary diet. The groups included mild cyclers, severe cyclers, and non-cyclers. The questionnaires that the participants filled out included values such as current weight, highest and lowest weights in the past four years, as well as data on experiences with binge eating and methods of weight control among others. This study doesn’t necessarily demonstrate mindful eating techniques however it illustrates clearly how many women mindlessly eat and are often unsuccessful in sustaining methods of intentional weight loss. This study revealed that weight cyclers gained more weight than non-cyclers over an eight year period with the findings not related to age or BMI (Field et.al. 2004).

A mindfulness based program called Mindfulness Based Eating Awareness Training (MB-EAT), was developed by Jean Kristeller (2003) and uses several guided mini-meditations. Some of these are similar to what is employed in the MBSR-Id program. A study was conducted testing mindfulness as an aid (or cure) to eating disorders based on the belief that eating disorders are associated with some sort of emotional distress (Smith et.al. 2006). Smith et.al (2006) used a mix of a modified Kabat-Zinn’s MBSR and Jean Kristeller’s MB-EAT program. The modification made to the MBSR program was that there was a much larger focus on the mindful eating aspect. The hypotheses were that participants would reduce binge eating as well as increase self-acceptance. Results supported both hypotheses and showed that those who had emotional issues along with the binge eating had more profound changes. Also, a small change was recognized in those with mild binge eating disorder which could potentially prevent them from becoming severe binge eaters or even obese in the future. The correlation seen between a decrease in anxiety and a decrease in binge eating supports that “mindfulness may reduce the need for emotional eating” (Smith, et. al. 2006). An additional study by Baer, Fischer, and Huss

(2006) showed a steady drop in binge eating over the course of their mindfulness based program. The woman's mindset about the experience of eating also changed; "she eats only what she wants, and stops when she is full" (Baer, 2006). These studies address diet change and weight loss but approach the subject in an innovative way. Unlike popular diet plans, the suggestions seek to change one's relationship with food and eating. The dietary changes develop as conscious personal decisions or as beneficial side effects. This is consistent with behavior change theories that suggest that change is always more successful when the patient feels they have made the change on their own (Glanz et.al. 2008). In the process of becoming more mindful, participants may decide to change their relationship with food.

Additional studies address lifestyle interventions and MBSR for Type II diabetes. The first was a meta-analysis done by Gillies et.al. (2007), which was interested in preventing or delaying the onset of type II diabetes in people with impaired glucose tolerance. Results showed that lifestyle interventions "can reduce the risk of type II diabetes in people with impaired glucose tolerance... and are at least as effective as pharmacological drugs" (Gillies, et. al. 2007). The second study was a pilot study that uses Kabat-Zinn's MBSR to improve glycemic control in which the researcher states "psychological distress is linked with impaired glycemic control in diabetics and increased risk of diabetes mellitus" (Rosenzweig et. al. 2007). This statement is congruent with statements in other studies that attribute mindless eating or uncontrolled bingeing with emotional distress. Unlike MBSR-Id and some of the other mentioned approaches, this study had participants complete the standard MBSR program. This study however used various outcome measures related to diabetes; diet or lifestyle changes were not recorded or considered. There were findings that participants' stress levels were reduced as a result of the study but no significant short term weight loss was seen over the course of the eight weeks. This does not take

into account that there were diet or lifestyle changes that could result in eventual weight loss. This was simply a small pilot study but showed enough supporting data that “warrants further investigation of MBSR with a randomized clinical trial”, as this was the first intervention specifically with type II diabetic participants (Rosenzweig, et. al. 2007). Perhaps mindfulness interventions create underlying lifestyle changes that will have physical consequences (i.e. dietary changes).

In the August 2009 issue of the Journal of the American Dietetic Association a validated mindful eating questionnaire came out. The questionnaire probed five areas that affect mindful eating and they were outlined to include disinhibition, awareness, external cues, emotional response, and distraction. After completing the questionnaire, the Mindful Eating Questionnaire (MEQ) score was calculated. The major findings of the study that used this new tool was that yoga is associated with the MEQ score more than regular exercise and that a higher BMI is associated with a lower MEQ score. This suggests the use of mindfulness intervention as an aid for diet change may lead to a decrease in BMI. A similar study by Lemoine and McCarthy (2008) investigated mindless eating as a predictor of BMI. The major finding of this study was that adults who engage in mindless eating behaviors tend to choose unhealthy foods. However, there was not a strong correlation between mindless eating and BMI. Researchers predicted that participants may have been pairing their unhealthy eating with exercise. This study gives light to the other side of the spectrum saying that mindless eating will not necessarily cause an increase in BMI but that it could promote unhealthy eating habits which may lead to other health concerns.

An Australia study, (Kenardy et.al. 2003), analyzed mindful eating behaviors in a non-eating disordered population, similar to the participants in this study. *Eating, mood, and gender*

in a noneating disordered population (2003) looked at gender differences and mood variations and how these affected eating behaviors. The outcome of this study was that gender did not play a huge role in affecting eating specific eating behaviors, nor did being in a bad mood. The most widely significant result was that participants who were in positive moods while eating, tended to exhibit more mindful eating behaviors and choose healthier foods (Kenardy, et.al. 2003).

Another fairly large study done in the Netherlands suggests the use of a mindfulness intervention in the global sense. The selection criteria for this study asked for only females from the university but had no mention of eating disorders so it was assumed that the sample would be a nonclinical population. The 475 participants took a Dutch Eating Behavior Questionnaire (DEBQ) and were then classified as either restrained eaters or dieters, emotional eaters, or eaters in response to external cues. The fact that all of the females that took the questionnaire were able to be put into one of the three above mentioned categories is a major indication that these women are not eating mindfully. All three groups were classified according to examples of mindless eating behaviors and the results of the study show that each of these types of eating could affect caloric intake (Anschutz, et.al. 2009).

Many of the previous studies worked with populations of teenagers or college age young adults to demonstrate the utility of a mindfulness intervention in those populations. However a study done at Stanford University (Rizvi et.al. 1999) was interested in the prevalence of disordered eating among a more middle-aged group of women. The ages of the participants ranged from 25-43 years old and these women were followed for six years with the expectation that their concerns with eating would decrease with age. Startlingly, the results of 166 women for BMI and several validated eating behavior scales showed that BMI increased with age and in general, women showed no decrease in disordered eating attitudes with age (Rizvi et.al., 1999).

The parent study for *Evaluating a Mindfulness Intervention as an Aid in Dietary Change* was *Chronic Inflammation and Mindfulness Intervention*. The purpose of the large study was to determine if the Mindfulness Based Stress Reduction- low dose (MBSR-ld) “can produce greater decreases in biologic measures of chronic inflammation and stress... when compared to a standard stress reduction protocol” (Malarkey, Klatt & Jarjoura, 2008). There were 90 participants in each the MBSR-ld program and the standard lifestyle program. The MBSR-ld program differed from Kabat-Zinn’s original program in that the daily meditations were 20 minutes as opposed to 45 minutes to an hour and the weekly lunchtime meetings were reduced to one hour as opposed to 2.5 to 3 hours. The original MBSR program involved a six hour retreat and the low dose version reduced the retreat to two hours. The intervention method in the MBSR-ld group involves “education, breathing, relaxation, body scans, and gentle yoga as facilitation towards a meditative state” (Malarkey et. al. 2008). During each of the weekly hour meetings, the MBSR-ld instructor lectures on a different theme. One of the weeks focused on mindful eating practice. In contrast, the active control group, a lifestyle intervention program, read lessons on healthier eating habits but had no experiential mindfulness practice. The population used for this study was Ohio State University faculty and staff volunteers. The age range of the population was 35-60 years old as this range included participants who likely had some form of inflammation in their bodies. Recruitment was via e-mail, posters, and a public radio announcement. The data collection was conducted in an online application StudyTrax. Participants filled out two week diaries before and after the eight week intervention. The online diary asked questions about a wide variety of stress related and lifestyle habits including eating behaviors which was the section of interest for this project.

METHODS

Data Source & Participants

The larger study that supplied data for this study was conducted at The Ohio State University by William B. Malarkey, MD, Maryanna Klatt, PhD, and David Jarjoura, PhD. Participants were recruited from a base of 18,000 staff at The Ohio State University. One hundred and eighty men and women ages 35-60 were recruited via campus emails, posters, and the university's public radio station. The primary aim of *Chronic Inflammation and Mindfulness Intervention* was to determine if the MBSR-ld program could produce lower levels of inflammation and biomarkers of stress as compared to the standard lifestyle intervention program. Exclusion criteria were assessed via a phone interview. The exclusion criteria included: (a) A history of receiving a diagnosis of and/or treatment for a chronic (more than one month), medical condition or requiring treatment for a psychiatric disorder within the past year; (b) Pregnancy or amenorrhea in pre-menopausal women; (c) taking medications that affect inflammation, and/or the endocrine and immune system; (d) experienced a major life stress such as death in the family in the past two months; (e) inadequate reading skills for the study found during the screening interview; (f) fear of needles or computers; (g) participates in a regular exercise program greater than thirty minutes per day; (h) alcohol intake in excess of two drinks per day (two 1.25oz shots of liquor, two 12oz containers of beer, or two 6oz glasses of wine); (i) recreational drug use; (j) vaccination during the past two months; (k) a cold or other illness in the past month; (l) edentulous; (m) a BMI of ≥ 40 ; (n) previous practice of mind-body relaxation

techniques and (o) smoking more than half of a pack of cigarettes per day, and a CRP level in the blood $< 3\text{mg/L}$ or $> 10\text{mg/L}$. One hundred and eighty men and women were recruited and then randomized into two groups of ninety. Each group received eight weeks of training, the intervention group receiving MBSR-ld with the active control being standard lifestyle training. Each participant was instructed to complete the daily diaries each day for fourteen days prior to the intervention as well as fourteen days after the intervention. Each participant was compensated \$325.

Measures

The data pieces from the *Chronic Inflammation and Mindfulness Intervention* daily diaries used for *Evaluating the Mindful Eating Approach as an Aid for Diet Change* were gleaned from a non-validated food frequency questionnaire (FFQ) and five questions on eating patterns. Although the FFQ was not validated, the questions were generated from one of the principle investigators of the parent study. The main concern was brevity, as the entire diary that participants were expected to fill out every day was eleven pages long. A validated traditional FFQ may take someone up to thirty minutes to complete and the purpose of this study was to assess a low dose intervention. Thus, having a diary longer than the daily intervention would not have been efficacious. Aside from the traditional food groups represented in the FFQ for this study, there were also food groups including popular fast food items such as hamburgers and milkshakes, which were an area of investigative interest to the principal investigator of the study. The five questions on eating patterns were related to mindful eating behaviors such as, “Did you

watch television while eating today?” This is an example of an eating pattern that is not mindful. Unbeknownst to the participants, each of the five questions were labeled either mindful or non-mindful eating patterns and we assigned a zero or one value accordingly to calculate the mean scores for the participants over the two weeks each pre and post intervention. These five questions that were created by the principle investigators of the parent study also were not validated as a tool for evaluating mindfulness, but were used to explore mindful eating under the larger umbrella of mindfulness activities. The parent study also had the participants complete a Mindful Attention Awareness Scale (MAAS) survey, a validated tool to determine dispositional mindfulness, once before the intervention and once after the intervention (Brown and Ryan, 2003). The MAAS, attached at the end of the study, contains 15 questions about dispositional mindfulness and participants answer each question with a value of 1-6, with 1 indicating “almost always” and with 6 indicating “almost never”. The responses to the 15 questions are summed and divided by 15 to get a score of 1-6, 6 indicating the highest level of dispositional mindfulness. This tool was not specifically probing food choices or eating patterns but rather an overall level of mindfulness.

Statistical Analysis

All statistical analyses were done using SPSS (Statistical Package for the Social Sciences). Comparative analyses were done on the food choices, overall mindfulness and mindfulness in eating patterns of the participants in both groups. Of primary concern was

whether or not any changes took place, what kind of changes were made in food choices, overall mindfulness, and mindfulness in eating patterns pre to post intervention. Pairwise T-tests were conducted to analyze all data. The first step was to get the total value for all three of the data sets of concern, food frequency questionnaire (FFQ) to analyze food choices, Mindful Attention Awareness Scale (MAAS) scores to analyze changes in overall mindfulness, and five daily diary eating pattern questions to analyze mindful eating patterns.

The following exclusion criteria were used to determine which data sets and participants were eligible for data analysis. Not all participants completed the diaries each of the twenty-eight days. Participants were excluded from analyses if they responded to less than eight days of either the pre-intervention FFQ or post-intervention FFQ. If they responded to eight or more days out of fourteen, the total number of servings they consumed in fourteen days for each food group was calculated by getting the sum of the servings they consumed for the entire fourteen days and dividing by the number of days out of the fourteen that they completed the FFQ, then multiplying by fourteen to normalize all responses. Only participants who completed both the pre and post MAAS surveys were included (n=175). For the five questions on eating patterns, participants were excluded if they missed only one question in either the pre or post diary since there were only five questions to examine. All analyses and comparisons were done using a pairwise T-test after we found the total numbers of all of the listed data sets of interest. The pairwise T-test was most appropriate to gauge if participants changed over time in regards to particular eating habits and mindfulness measures. For analyses, the results were separated by arm, whether they were in the mindfulness group or the lifestyle intervention group. It was not possible to separate by gender as there were not enough men in the study to make the results significant, given the study sample size.

RESULTS

For this study, further exclusion criteria were in place regarding analysis of the sections of dietary data as well as the MAAS results. Using the above mentioned exclusion criteria, there was sufficient FFQ data for 83 participants in the mindfulness group and 84 participants in the lifestyle education group. For the five questions on mindful eating patterns there was sufficient eating pattern data for 84 participants in the mindfulness group and 86 participants in the lifestyle education group. The third set of data analyzed were the results of the MAAS scores. Each participant completed the MAAS survey once prior to the intervention as well as once after the intervention. We had pre and post MAAS scores for 86 participants in the mindfulness group and 89 participants in the lifestyle education group.

The mindfulness group received one out of the eight weeks of education on healthy food choices and eating behaviors and patterns. The lifestyle intervention group has lessons that included education about healthy food choices and eating behaviors and patterns in six out of the eight weeks. See Figure 2.

Figure 3 is a data chart representing the changes in food choices of the participants in the mindfulness intervention group and Figure 4 is a data chart that represents the changes in food choices of the participants in the lifestyle intervention group.

Figure 5 includes a data chart as well as graphic representation of the perceived mindful eating patterns that changed pre to post intervention. Figure 6 is a data chart representing the results when the five mindful eating pattern questions were analyzed individually.

Figure 7 includes a data chart as well as graphic representation of the changes in MAAS score pre to post intervention for both arms.

Figure 2. Food & Eating Behavior Education Comparison

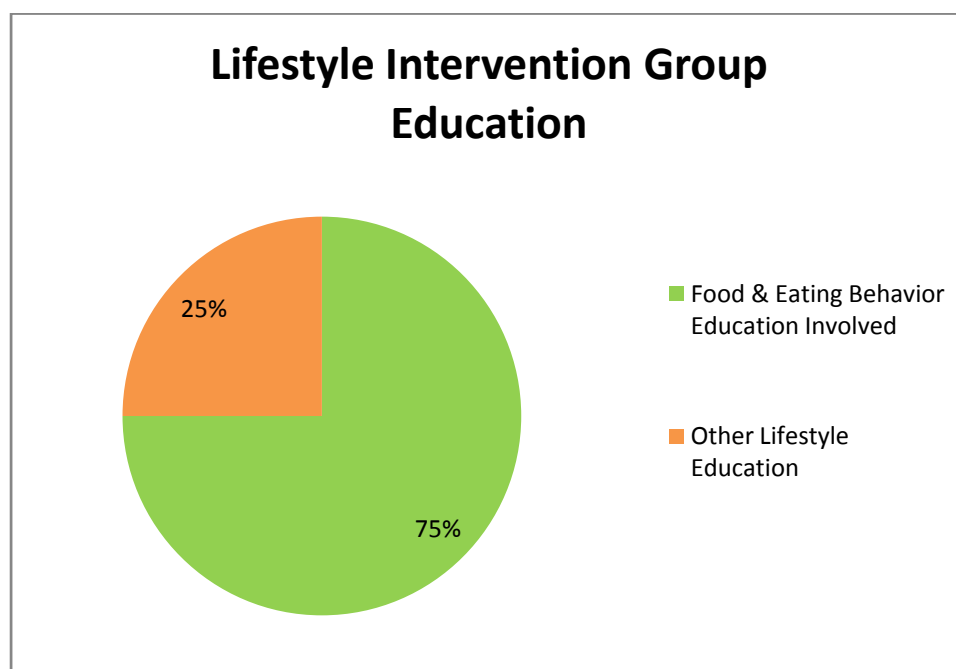
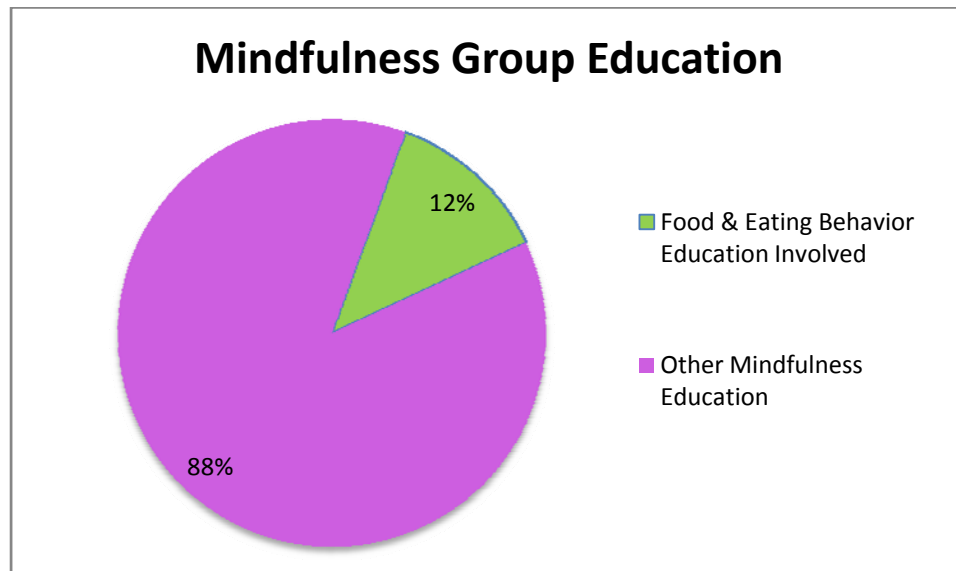


Figure 3. Changes in FFQ pre to post intervention for the mindfulness group

Mindfulness Group (n=83)							
	p-value						
	Avg # of servings consumed per day pre-intervention	Avg # of servings consumed per day post-intervention	Average Change	Standard Error of Change	t-value	Significance (Two-tailed)	Significant if p-value < 0.06
Cereals,breads, noodles	2.60	2.45	-0.15	0.07	-2.34	0.02	Significantly decrease after the training
Milk, yogurt, cheese	1.51	1.61	0.10	0.06	1.76	0.08	
Fruits and vegetables	2.38	2.40	0.01	0.07	0.20	0.84	
Burgers	0.53	0.70	0.17	0.07	2.56	0.01	Significantly increase after the training
French fries	0.15	0.12	-0.02	0.02	-1.10	0.27	
Fried chicken, fish, or other fried meat	0.29	0.26	-0.03	0.03	-0.89	0.38	
Meats not fried	1.36	1.15	-0.22	0.06	-3.93	0.00	Significantly decrease after the training
Pizza	0.30	0.32	0.02	0.04	0.51	0.61	
Sweet foods (cookies, cake, pies, candy, doughnuts, pastries)	1.14	1.09	-0.04	0.07	-0.61	0.54	
Salty foods (chips, nachos, pretzels)	0.72	0.70	-0.02	0.05	-0.42	0.68	
Beverages w/ calories (juices, juice drinks, pop)	0.59	0.62	0.03	0.04	0.73	0.47	
Milkshake or ice cream	0.21	0.26	0.05	0.04	1.47	0.15	
Alcohol (beer, wine, mixed drinks)	0.55	0.47	-0.08	0.04	-1.91	0.06	Significantly decrease after the training

Figure 4. Changes in FFQ pre to post intervention for the mindfulness group

Lifestyle Intervention Group (n=84)							
			p-value				
	Avg # of servings consumed per day pre-intervention	Avg # of servings consumed per day post-intervention	Average Change	Standard Error of Change	t-value	Significance (Two-tailed)	Significant if p-value < 0.06
Cereals,breads, noodles	2.29	2.38	0.09	0.08	1.15	0.26	
Milk, yogurt, cheese	1.48	1.49	0.01	0.06	0.15	0.88	
Fruits and vegetables	2.22	2.48	0.26	0.09	2.83	0.01	Significantly increase after the training
Burgers	0.69	0.68	-0.01	0.06	-0.19	0.85	
French fries	0.17	0.16	-0.01	0.02	-0.66	0.51	
Fried chicken, fish, or other fried meat	0.29	0.27	-0.01	0.03	-0.52	0.60	
Meats not fried	1.17	1.20	0.03	0.07	0.50	0.62	
Pizza	0.31	0.31	0.00	0.04	0.04	0.97	
Sweet foods (cookies, cake, pies, candy, doughnuts, pastries)	1.11	1.12	0.02	0.06	0.26	0.80	
Salty foods (chips, nachos, pretzels)	0.75	0.72	-0.03	0.06	-0.48	0.64	
Beverages w/ calories (juices, juice drinks, pop)	0.69	0.66	-0.03	0.05	-0.59	0.56	
Milkshake or ice cream	0.24	0.24	0.01	0.03	-0.19	0.85	
Alcohol (beer, wine, mixed drinks)	0.35	0.34	-0.02	0.04	-0.46	0.65	

Figure 5. Eating pattern question analysis

	Pre Intervention*	Post Intervention*	Change	Standard Deviation	p-value**
Mindfulness Group (n=84)	42.57	45.45	2.88	1.04	0.01
Lifestyle Intervention Group (n=86)	40.43	41.83	1.40	1.24	0.26

*values are out of 70 (5 responses per day for 14 days); 0 = least mindful; 70 = most mindful

**only the Mindfulness Group had significant changes in their mindful eating behaviors because $p < 0.05$

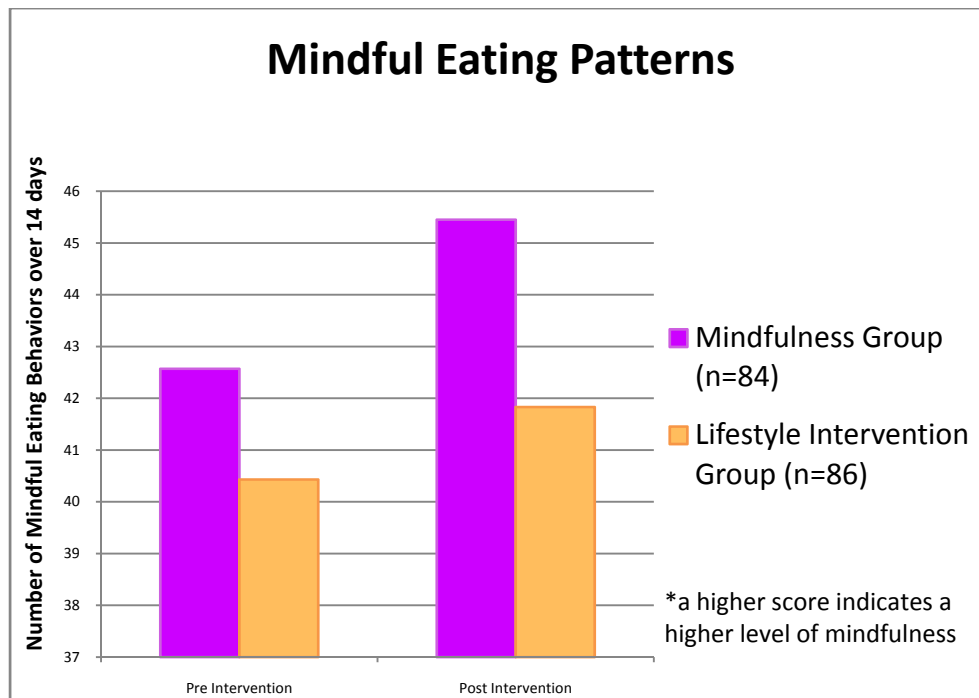
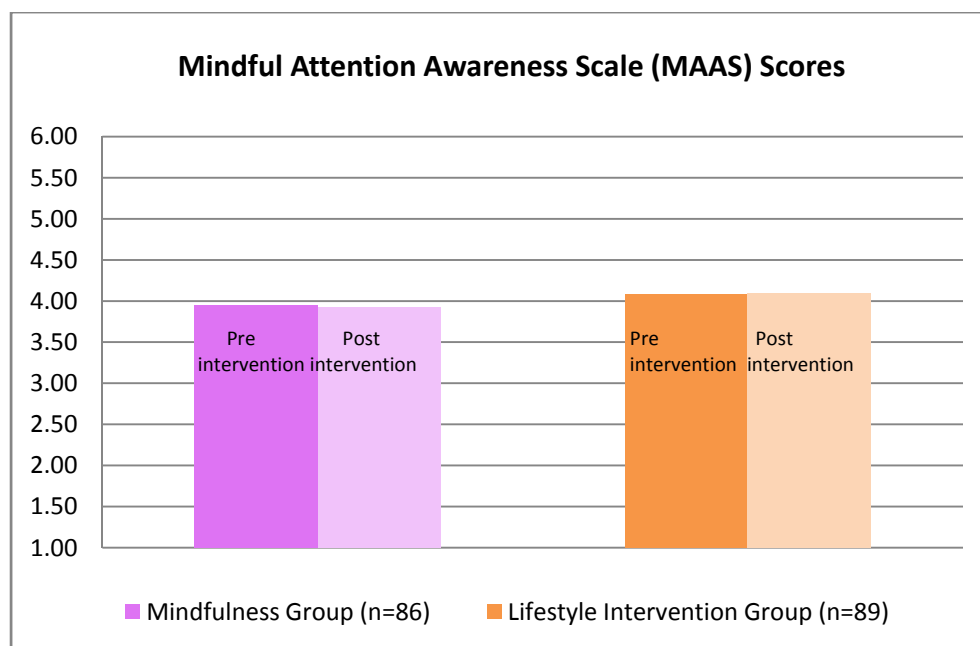


Figure 6. Summary of mindful eating pattern questions analyzed individually

	Mindfulness Intervention Group (n=84)		Lifestyle Intervention Group (n=86)	
Question	Mean Change (post-pre)	p-value	Mean Change (post-pre)	p-value
Today did you eat quickly?	-0.694	0.079	-0.535	0.146
Today did you do other things while eating?	-0.469	0.271	-0.314	0.514
Today did you think about an upsetting event or person while eating?	-0.416	0.209	-0.249	0.408
Today did you overeat?	-0.150	0.675	0.144	0.751
Today did you focus on how the food tasted?	-1.150	0.010	-0.448	0.196

Figure 7. There were not significant changes in scores between the groups looking at pre to post intervention MAAS scores

	Pre Intervention*	Post Intervention*	Change	Standard Deviation	p-value	Percent Change**
Mindfulness Group (n=86)	3.95	4.09	0.14	0.05	0.01	2.33%
Lifestyle Intervention Group (n=89)	3.93	4.10	0.17	0.06	0.01	2.83%
<p>*values are out of 6 from the validated MAAS survey; 0 = lowest level of mindfulness; 6 = highest level of mindfulness</p> <p>**although the p-values are low, the percent change relative to the narrow scale of the MAAS scores makes the change insignificant</p>						



DISCUSSION

This may be one of the first study to analyze the effects of training in low-dose mindfulness, including meditation and yoga practices, in a non-clinical population. Findings from this study are consistent with data from prior research that suggests that being mindful while eating could affect eating behaviors. (Baranowski and Hetherington, 1999). The two different programs involved in this study were developed by one of the principle investigators of the parent study. It was intended that there would be the intervention arm, a group of participants who would receive a low-dose version of 8 weeks of mindfulness-based training, and a control arm, a group of participants who would receive lifestyle modification training. Did MBSR-ld impact food behaviors for participants in the intervention group? Yes, but there was not a statistically significant difference between the results of both arms. The active control group did experience an intervention as well and that it may have unknowingly affected their mindfulness. Filling out the daily diaries themselves could be considered a mindfulness activity. Mindfulness is simply an increase of awareness in the present moment. Additionally, both arms were being educated and education increases awareness. The active control group was referred to as the ‘lifestyle intervention’ group. A difference between the groups was that each arm had a different amount of education on healthy foods and eating behaviors.

Figure 2 displays the amount of time each arm of the study was educated on food choices and behaviors. It is clear that the mindfulness intervention group spent only one of their eight weeks on food choices and behaviors (such as eating mindfully) while the lifestyle intervention group had lessons about healthy eating choices and behaviors included in six of their eight weeks

of education. As Figure 2 shows, it might be expected that the lifestyle intervention group would exhibit more changes in their eating patterns being that they had so much more education on food behaviors than the mindfulness intervention group, but the mindfulness intervention group was more successful in altering food choices.

Figures 3 and 4 show the results of the FFQs indicating the mindfulness intervention group made four significant changes in their diets whereas the lifestyle intervention group only made one significant change pre to post intervention. Unfortunately because of the limiting factors of a FFQ, it is difficult to decipher the quality of each diet change. For example, the mindfulness intervention group exhibited a decrease in meats that were not fried. With that broad food group topic, we are unable to determine whether the meat they consumed was high-fat or low-fat, grilled or breaded, or what was involved in the preparation of the meat. This ambiguity inhibits us from undoubtedly determining whether or not the participants' decrease in consumption of meat servings was nutritionally beneficial to their diet.

Likewise, for the decrease in cereals, breads, and pastas, this could also be a positive or negative change depending on whether the carbohydrate sources were refined or whole grains or what other ingredients were part of the dish that included cereal, bread, or pasta. For the increase in burgers, this could also be a positive or negative change. An example of a positive change would be if the participant decreased his/her fried meat intake and replaced those items with organic low-fat beef hamburgers. Several studies such as (Weisburger, 1997) have shown that high-fat foods have detrimental effects on our health. A decrease in alcohol intake is generally thought of as a positive change however this too could go the other way. For example, if the participants were only drinking 5 ounces a day, the daily allowed recommendation of red wine, and then decreased his/her consumption, he/she may be eliminating beneficial antioxidants at the

same time (Mayo Clinic Staff, n.d.). Also, the increase in consumption of fruits and vegetables is generally viewed as a positive diet change however, if the participant was already consuming the suggested amount of servings of fruits each day and the sources that increased his/her fruit intake were energy dense desserts such as the cherry filling of a cherry pie, this could be a negative diet change. One shortcoming of FFQs is that they fail to capture specifics about dietary intake but rather offer an overall broad scope of peoples' diets. Another limiting factor of this specific FFQ and several other validated FFQs is that participants only have the option of marking up to 4 servings of a food or food group. There is a '4 or more' option however for statistical analysis purposes we had to use the number 4 as the amount of servings they consumed even if in reality it was more than four servings. It was impossible to know whether a participant actually consumed four servings or if they consumed eight servings. A further study with a more detailed dietary collection method or even an FFQ with the opportunity to select up to 10 servings of any one food group would give us a much more accurate picture of peoples' actual food and beverage intake. Perhaps practicing mindful techniques such as yoga and meditation will give someone a more global awareness of their body. Being mindful allows one to recognize their hunger and satiety cues in their body and respond to them. Attending to these natural cues in the body could discourage someone from overeating or eating mindlessly.

Figure 5 depicts how the participants responded to the five mindful eating pattern questions in the daily diaries. These questions were not validated to measure mindfulness were used as a tool to see if the participants would increase their mindful eating patterns after the intervention. The participants responded with a 'yes' or 'no' to each of the five questions which included: "Today did you eat quickly? Today did you do other things while eating? Today did you think about an upsetting event or person while eating? Today did you overeat? And "Today

did you focus on how the food tasted?” The first four questions are about not being mindful while eating. The last question is a very mindful behavior. For analysis purposes we coded the questions appropriately as mindful or not mindful responses, gave the same value to each of the five questions, and got the sum of each participant’s responses over the two weeks each before and after the intervention. It was expected that the mindfulness intervention group would have a greater increase in mindful eating patterns. The data shows that both groups did have an increase in practicing mindful eating patterns however only the results of the mindfulness group were statistically significant. These results show that even though the mindfulness intervention group only got one week of education on mindful eating, healthy food choices and eating behaviors, their mindful eating patterns significantly increased more so than the lifestyle intervention group who received six weeks of education that included healthy food choices and eating behavior modification. They received much less food education but achieved larger dietary changes.

Figure 6 shows the specific mindful behaviors that were increased by the mindfulness intervention group. There were no statistically significant changes in any particular area for the lifestyle intervention group, with one statistically significant change for the mindfulness intervention group. One area in which the mindfulness intervention group answered significantly more mindful after the intervention was that they had an increase in focusing on how the food tasted. This particular question may probe mindfulness better than any other question, as it directly asks about the participants relationship with their food and being in the present moment while eating. This is certainly a positive sign for the efficacy of the mindfulness intervention as an aid in dietary change.

Figure 7 shows the analysis of the MAAS scores. As mentioned, the MAAS is not specifically probing mindful eating patterns but rather an overall level of dispositional

mindfulness. The hypothesis was that the mindfulness intervention group would have a greater increase in their MAAS score as compared to the lifestyle intervention group. Contrary to our hypothesis, both arms had an increase in their MAAS score however it was a very minor increase and not significant on the narrow scale of 6 allowed by the MAAS. This result could be due to the fact that each arm did have the same amount of interactive education as far as classroom time. Both arms had 8 one-hour sessions of education on lifestyle modification and this interaction alone could have caused participants in either group to become more mindful overall, as filling out the daily diaries may have impacted mindfulness for both groups. Consistent with a study done by Baranowski and Hetherington in Scotland (1999), an eating disorder prevention program where one group was offered a textbook approach, yet all participants experienced benefits and a decrease in disordered eating patterns. This shows that mindfulness can be learned in more than one way and that the majority of the participants in both arms received some increase in mindfulness.

Longitudinal results will be forthcoming. Mindfulness is a technique that participants can employ in their lives not just for the intervention period but for months or years. Perhaps the lessons they learned in mindfulness will allow them to incorporate mindfulness into other areas of their life giving them a greater appreciation of the present moment and more awareness of their mental, physical, and emotional health and well-being. The mindfulness intervention group will continue to be followed over time and the long-term results of that study will add validity to evaluating mindfulness, more so than two-week post intervention results.

There were several limitations to the design of *Evaluating the Mindful Eating Approach as an Aid for Diet Change*. The primary limitation was that data was used from a parent study so there was no opportunity for input on the data collection method or food frequency

questionnaire. This is not to say that the data is invalid but in order to determine the quality of a diet change, more extensive studies need to be done to define what positive and negative diet changes are. A more detailed food record method might be able to quantify and qualify the nutritional benefits to the diet changes that participants make. Indeed, the mindful eating approach was effective in influencing diet changes for the mindfulness intervention group however it was beyond the scope of the data collected to evaluate the quality and benefits of the specific diet changes that were made by participants. In the next study that evaluates a mindfulness intervention as an aid for diet change, dietary intake questions and eating pattern questions could be the exclusive data collected in hopes that the participants wouldn't be burdened with a lengthy daily diary and would record their food intake with honesty and specificity. A food record would be a helpful data collection tool. The limitations with food records are that they are incredibly expensive to analyze and participants may easily forget to include details about the types of food or beverages they consumed. Yet, even without the details needed to qualify the diet changes made by the participants, it was still apparent that their diets changed which warrants further investigation into this method as an aid for diet change. With 67% of the adult population in our country overweight or obese, (CDC, 2006). We need innovative methods to aid in diet change. Perhaps a relatively short-term mindful training could be part of the solution to the obesity epidemic.

CONCLUSIONS

Although both groups were more mindful after the intervention, as indicated by the increase in MAAS scores, the mindfulness intervention program is associated with significantly more diet changes than the lifestyle intervention program. Furthermore, the mindfulness intervention group, who spent just 12.5% of their time learning about healthy food and eating behaviors, showed four significant dietary changes. The lifestyle intervention group, who spent 75% of their time learning about healthy food and eating behaviors, showed only one significant dietary change. The mindfulness intervention program appeared to induce mindful eating patterns. Most notably, they significantly focused on how their food tasted. The lifestyle intervention program was not successful in producing similar outcomes. Findings suggest the utility of mindfulness training as an aid for diet change.

Appendix I

Mindful Attention Awareness Scale (MAAS)

Instructions: Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be. Please treat each item separately from every other item.

1	2	3	4	5	6
Almost	Very	Somewhat	Somewhat	Very	Almost
Always	Frequently	Frequently	Infrequently	Infrequently	Never

I could be experiencing some emotion and not be conscious of it until some time later.	1	2	3	4	5	6
I break or spill things because of carelessness, not paying attention, or thinking of something else.	1	2	3	4	5	6
I find it difficult to stay focused on what's happening in the present.	1	2	3	4	5	6
I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	1	2	3	4	5	6
I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	1	2	3	4	5	6
I forget a person's name almost as soon as I've been told it for the first time.	1	2	3	4	5	6
It seems I am "running on automatic," without much awareness of what I'm doing.	1	2	3	4	5	6
I rush through activities without being really attentive to them.	1	2	3	4	5	6
I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.	1	2	3	4	5	6
I do jobs or tasks automatically, without being aware of what I'm doing.	1	2	3	4	5	6
I find myself listening to someone with one ear, doing something else at the same time.	1	2	3	4	5	6
I drive places on 'automatic pilot' and then wonder why I went there.	1	2	3	4	5	6
I find myself preoccupied with the future or the past.	1	2	3	4	5	6
I find myself doing things without paying attention.	1	2	3	4	5	6
I snack without being aware that I'm eating.	1	2	3	4	5	6

MAAS Scoring

To score the scale, simply compute a mean of the 15 items. Higher scores reflect higher levels of dispositional mindfulness.

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